Recap

Redundancy is Bad

accountNo	balance	customer	branch	address	assets
A-101	500	1313131	Downtown	Brooklyn	9000000
A-102	400	1313131	Perryridge	Horseneck	1700000
A-113	600	9876543	Round Hill	Horseneck	8000000
A-201	900	9876543	Brighton	Brooklyn	7100000
A-215	700	1111111	Mianus	Horseneck	400000
A-222	700	1111111	Redwood	Palo Alto	2100000
A-305	350	1234567	Round Hill	Horseneck	8000000
...	...	...	...	...	...

what if we want to

- change balance of A-113

- add new account

- delete account

- update branch address

Functional Dependency

X → Y

can be read as:

- Y functionally depends on X

- X determines Y

- if we know X then we know Y

Rules

reflexivity:	X → X	
augmentation:	X → Y	⇒ XZ → YZ
transitivity:	X → Y, Y → Z	⇒ X → Z
additivity:	X → Y, X → Z	⇒ X → YZ

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projectivity:           X → YZ          ⇒ X → Y, X → Z
pseudotransitivity:     X → Y, YZ → W ⇒ XZ → W
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What is a trivial functional dependency X → Y?

Y is a subset of X

Closure

X+   largest set of attributes that can be derived from X
using F

where

X   set of attributes

F   set of functional dependencies

Super Key

set of attributes that uniquely identifies a tuple in a table

any set X, such that X+ = R

Candidate Key

a.k.a primary key

minimal superkey

any set X, such that X+ = R and there is no Y subset of X such
that Y+ = R

Boyce-Codd Normal Form (BCNF)

for all functional dependencies X → Y

either

 • X → Y is trivial

or

 • X is a super key

Third Normal Form (3NF)

for all functional dependencies X → Y

either

  • X → Y is trivial

or

  • X is a super key

or

  • Y is single attribute of a candidate key

BCNF vs 3NF

	BCNF	3NF
lossless join	✅	✅
preserves all fds	❌	✅